Republic of France

Ministry of Trade

Department of Patent Rights

PATENT SPECIFICATION

P.V. No. 28,260 No. 1,447,531

International Classification: [illegible] A 24 c // C 09 j

New Cigarette Filters and Process of Production

Name of company: EASTMAN KODAK COMPANY, domiciled in the United States of America

Applied for on August 13, 1965 at 2:12 PM in Paris.
Issued by decree on June 20, 1966.
(Bulletin officiel de la Propriété industrielle
[Official Patent Bulletin],
No. 31 of 1966)

(Patent application filed in the United States of America on August 19, 1964 under No. 390,699 in the names of Mr. John Edward Kiefer and Clarence Earl Tholstrup.)

[Bottom of first page] 66 2191 0 73 531 3 ♦ Price of a copy: 2 francs

Translated from French by:
Michael J. Sidor & Co., Inc.
527 S. Mitchell Ave.
Arlington Heights, IL 60005
(847) 259-7697
File No.: MS4972

The present invention refers to filtering products and, more specifically, to new filter elements that can be used, in particular, for filtering tobacco smoke and that are produced from a film and fibers as well as a process and an apparatus for producing the filters.

Known are filters for tobacco smoke that are formed from a multiplicity of filaments oriented, in a general manner, in the direction of the smoke flow. It has been proposed to improve the filtering capacity of these filters by fixing to the surface of the filament a multiplicity of very short fibrils, the axes of which are essentially perpendicular to the direction of the gas flow..

It has been found that extremely efficient fibers are obtained for retaining the tars and nicotine of tobacco smoke by use of filters that consist solely of fibrils perpendicular to the general direction of the gas flow, without these fibers being fixed on filaments arranged in the direction of the gas flow. The filtering elements in accordance with the invention are formed from a film tube and short fibers, referred to hereinafter as "fibrils," fixed on the internal wall of this tube, and they are noteworthy particularly in that the fibrils are of unequal length and are bonded by an adhesive essentially perpendicular to the surface of the tube.

Indeed, it is extremely advantageous to use fibrils of unequal length, because it is then possible to form filtering rods such that the ratio of voids and filled spaces is nearly uniform over the entire extent of the cross section; for this reason, these filtering rods exhibit a nearly constant filtering capacity over the entire section. The filters thus realized exhibit a substantial retention capacity for the tars, the nicotine, and the other undesired constituents of tobacco smoke.

Also found has been a process for producing these new filters in a simple manner by an electrostatic route. The process in accordance with the invention for producing the new filtering products is particularly noteworthy in that it comprises the following series of operations:

1. A band of film formed from a polymeric material, selected for its properties of attracting and conserving electrostatic charges, is fed into the field of action of an adhesive applicator and this adhesive is applied to one face of the film;

2. The film is electrostatically charged;

3. The charged film is fed into a chamber containing the fibrils, which are short but of different lengths and are formed from a polymeric product that can be attracted by electrostatic forces so well that these fibrils orient themselves in the direction of the electrostatic field created

by the charged films and that one end of each fibril becomes fixed to the face of the film covered with the adhesive in such a way that it is essentially perpendicular to that surface;

4. The film on which the fibrils are fixed is bent in such a way as to form a continuous cylindrical tube containing an interlacement of fibrils in its interior, the two edges of the film being bonded to each other by an adhesive;

5. The essentially cylindrical rod thus formed is cut up into filtering elements.

In the attached drawing illustrating the invention:

Figure 1 depicts schematically an apparatus for producing the filter in accordance with the invention;

Figure 2 is a schematic view depicting the film with the fibers fixed perpendicular to its surface;

Figure 3 is a view of the film with the fibers fixed perpendicular to its surface prior to being fashioned into the form of a tubular element;

Figure 4 is a cross section of the finished filter element.

A band of film is pulled from the reel 10 (Fig. 1) by a feed roll 12 and passes through an applicator 14 that applies an adhesive product to one face of the film. This adhesive can be applied by spraying or by coating by means of a wick applicator or a moistened cylinder. If this adhesive contains water or another volatile product, it can be dried in the oven 16. The dried film is fed over a roll 18 and is charged electrostatically. This can be realized in a simple manner by feeding this film over a bar or a roll 20 made from material with marked dielectrical properties, such as hardened natural rubber; it is also possible to feed the film between two metallic plates connected to two terminals of a electric generator producing a potential difference of several hundred volts.

The film, thus charged, passes through a chamber 22 containing short fibrils of different length. Under the influence of the electrostatic field, these fibrils align themselves parallel to the liens of the field essentially perpendicular to the surface of the film. One end of each fibril becomes fixed to the adhesive, as seen in 24 and as shown in detail in Figures 2 and 3. The film, thus covered on one face by a large number of fibrils, is afterwards bent and folded by the guide 26 in such a way as to form a continuous tube, one of the edges of the film overlapping the other edge by about 1 mm to 3 mm. Thus obtained is a cylindrical rod, the cross section of which is depicted in Figure 4 and this rod is cut into filter butts constituting cigarette filters.

In the invention, it is possible to use any perpendicular sheet capable of receiving an electrostatic charge. This sheet can be fabricated, in particular, of cellulose acetate, of polyethylene, of polypropylene, of polystyrene, of polyester derived, for example, from terephthalic acid and polyethylene glycol or from bis(hydroxymethyl)cyclohexane. It is possible to use as fibrils all fibers capable of being attracted by an electrostatic force; the material of the fibrils can be that of the film or it can be different. For example, an excellent result is obtained with a film of polypropylene, which has a very high surface resistivity, this result being so good that the film is charged very easily, and with fibers of cellulose acetate, which retain very efficiently the phenols present in the flow of smoke. The average length of the fibrils lies between 2 mm and 9 mm.

The adhesive to be used depends on the film and on the fiber selected. It is possible to use a liquid that has a high boiling point and dissolves simultaneously both the fiber and the film; the mono-, di-, and triacetates of glycerol, the mono-, di-, and tripropionates of glycerol, the acetic and propionic esters of the polyoxyethylenes, the phthalic esters of alkyl alcohols, and triethyl citrate constitute, for example, good adhesives for cellulose acetate.

Neoprene adhesives, epoxide adhesives, polyvinyl acetate, polyvinyl chloride, and butadiene-styrene resins are particularly suitable for the polyolefins and polyesters. When the adhesive contains water or a solvent, it is advantageous to subject the film to drying or to a hardening treatment in, for example, the oven 16 of Figure 1 prior to applying to it an electrostatic charge.

The following examples illustrate the invention:

Example 1. — A band of film made of cellulose acetate that is 29 mm in width and 0.1 mm thick is used. Glycerol triacetate is sprayed onto one face until the weight of the film has increased by 5/100. The opposite face of the film is rubbed with a hard natural rubber roll in order to charge this film electrostatically. The film is fed beneath a thin layer of fibrils of cellulose acetate of irregular length in such a way that the face of the film moistened with glycerol triacetate passes into a bed of fibrils with a thickness of about 5 mm. The fibrils, which have an average length of about 6 mm, align themselves perpendicular to the film, one end of each fiber being supported on the film so well that the glycerol triacetate, which dissolves simultaneously both the film and the fiber, forms a permanent seal between the two. The film, thus covered on one face with perpendicularly arranged fibrils, is then fashioned into the form of

cylindrical rods containing the fibrils in the interior. One edge of the film overlaps the other and is bonded to the latter by means of glycerol triacetate. The rod thus fashioned is cut into fragments that have a length of 20 mm and that are attached to commercial cigarettes. These cigarettes, joined to filtering butts, are sampled in a smoking machine and the quantities of phenol and of fluorescent compounds and the total quantity of products retained by the filter are measured. The results are compiled in Table I below:

Table I

Constituents of the smoke	Fractions retained by the filter	Method of examination
Phenols	86/100	Based on D. Hoffmann and E. L. Wynder (Beiträge zur Tabakforschung Issue 1 *3*, 101 - 106)
Fluorescent products	54/100	W. V. McConnell, R. C. Mumpower, and G. P. Touey (Tobacco Science: *4*, 55 -61)
Total of particulate matter ...	51/100	C. L. Ogg, W. W. Bates Jr, E. C. Cogbill, R. H. Blackmore, and E. L. Petersen (J. A. O. A. C: (3) *45*, 540 - 545)

Example 2. — A neoprene additive (additive: "Carboline neoprene," manufactured by Carboline Co. in the United States) is sprayed onto one face of a polypropylene film having a width of 29 mm and a thickness of 0.050 mm, the increase in weight of the film being 5/100. The film is charged electrostatically as in Example 1. This film is fed through a vessel containing polypropylene fibrils having an average length of about 5 mm and a titer of 0.044 tex per filament. These fibrils align themselves parallel to the lines of force of the electrostatic field and perpendicular to the film, one end of each fiber coming into contact with the latter. The film thus treated is fashioned into the form of a cylindrical rod and it is cut up into cigarette filters as in Example 1. A filter that is 20 mm in length retains 63/100 of the fluorescent products and 61/100 of the total amount of solid matter in the cigarette smoke in an experiment conducted as in Example 1.

Obviously, the invention is not limited to the embodiments described and depicted, which were only chosen by way of example.

SUMMARY

The object of the invention is, in particular:

1. A filtering element formed from a film tube and short fibrils contained in this tube, this filtering element being particularly noteworthy in the following characteristics, considered separately or in combination:

a. The fibrils are of unequal length and are bonded by an adhesive essentially perpendicular to the surface of the tube;

b. The material of the film tube is made of cellulose acetate, of polyethylene, of polypropylene, of polystyrene, or of a terephthalic ester of ethylene glycol or of bis(hydroxymethyl)cyclohexane;

c. The fibrils are made of cellulose acetate, of polyethylene, of polypropylene, of polystyrene, or of the polyterephthalate of ethylene glycol or of bis(hydroxymethyl)cyclohexane;

d. The fibrils are fixed on the film by an adhesive selected from the group consisting of the mono-, di-, and triacetate of glycerol, the mono-, di-, and tripropionate of glycerol, the acetic and propionic esters of the polyoxyethylenes, the phthalic esters of alkyl alcohols, ethyl citrate, neoprene adhesives, epoxide adhesives, polyvinyl acetate, polyvinyl chloride, and butadiene-styrene resins;

e. In accordance with one embodiment serving particularly for the filtration of tobacco smoke, the fibrils of different lengths have a mean length lying between 2 and 9 mm;

f. In accordance with one special embodiment, the film is formed from polypropylene and the fibrils from cellulose acetate;

g. In accordance with another special embodiment, the films and the fibrils are formed from cellulose acetate and are joined together by means of glycerol triacetate;

h. In accordance with another embodiment, the film and the fibers are formed from polypropylene and are joined together by means of a neoprene adhesive;

i. The filter element is incased.

2. A process of producing the filters defined under 1, this process being noteworthy particularly in the following characteristics, considered separately or in combination:

a. A band of film is fed into an adhesive applicator, which fixes the adhesive on one face of the film; after eventual drying, the film is charged electrostatically; the film is fed into a

chamber containing short fibrils of unequal length, which fixes the fibrils at one of their ends to the face of the film coated with adhesive; the band of film is bent and folded in order to form a tube containing the fibrils in its interior, the edges of the film overlapping sufficiently so as to be bonded to each other by means of the adhesive; this filtering rod is cut up into filtering elements;

b. The electric field is generated by feeding the film over an object made of strongly dielectric material or between two metallic plates connected to a potential difference of several hundred volts;

c. In accordance with a special embodiment, glycerol triacetate is sprayed onto one face of a film band made of cellulose acetate and having a thickness of about 0.1 mm until its weight has increased by 5/100; the opposite face of the film is rubbed with a hard natural rubber roll in order to create the electrostatic charge; the face of the film that is moistened with glycerol acetate is fed into a bed that has a thickness of about 5 mm and is formed from fibrils of cellulose acetate that have different lengths, but which are equal on average to 5 - 6 mm, this arranging the fibrils perpendicular to the face of the film and bonding them adhesively by one end to the latter; the film is bent and folded into the form of a cylindrical rod containing the fibrils in its interior, the edges of this film overlapping and being bonded adhesively by means of glycerol triacetate; and the tube that is thus fashioned is cut up into fragments that are 20 mm in length;

d. In accordance with another embodiment, a neoprene adhesive is sprayed onto a polypropylene film having a thickness of about 0.05 mm until the weight has increased by 5/100; this film is charged electrostatically and is fed into a vessel containing polypropylene fibrils that have different thicknesses, but are equal on average to 5 mm, and that have titers per filament of the order of 0.044 tex, this fixing the fibrils perpendicular to the surface of the film; the film is fashioned into a tube containing the fibrils in its interior and the tube is cut up into filtering elements.

3. As new industrial products, the cigarettes and other smoking products containing the filters defined under 1.

Name of company:
EASTMAN KODAK COMPANY
Agent:
Cabinet [Law Office] Lavoix

To purchase copies, write to the IMPRIMERIE NATIONALE [NATIONAL PRINTERS], 27, rue de la Convention, Paris (15).

No. 1,447,531 Name of company: Only page

Eastman Kodak Company

FIG. 1

FIG. 2

FIG. 3

FIG. 4

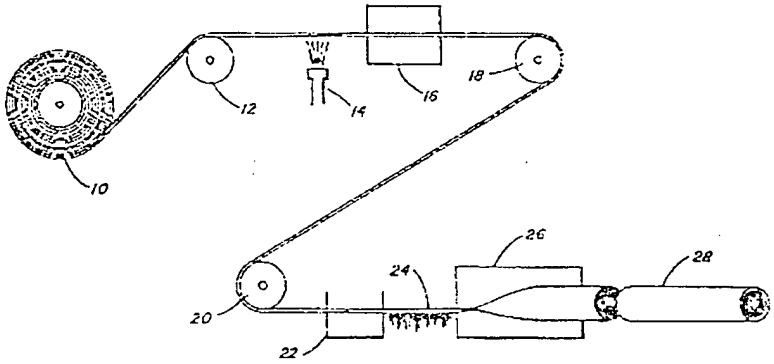

FIG. 1.

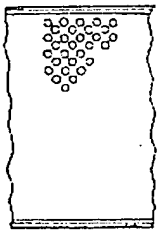

FIG. 2.

FIG. 4.

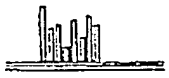

FIG. 3.